# HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

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| **Hatchery Program:** | Snow Creek Coho Salmon Supplementation |
| **Species or Hatchery Stock:** | Coho salmon (*Oncorhynchus kisutch)* Snow Creek |
| **Agency/Operator:** | Washington Department of Fish and Wildlife |
| **Watershed and Region:** | Snow Creek (Strait of Juan de Fuca) Puget Sound |
| **Date Submitted:** | March 17, 2003 |
| **Date Last Updated:** | December 16, 2002 |

## SECTION 1. GENERAL PROGRAM DESCRIPTION

**1.1) Name of hatchery or program.**

Snow Creek coho salmon supplementation program

**1.2) Species and population (or stock) under propagation, and ESA status.**

Snow Creek Coho (*Oncorhynchus kisutch*) - not listed

**1.3) Responsible organization and individuals**


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**Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:**

Some funding and Labor and Industries insurance for volunteers provided through Regional Fish Enhancement Group North Olympic Salmon Coalition (NOSC) and Wild Olympic Salmon (WOS); Point No Point Treaty Council and tribes.

**1.4) Funding source, staffing level, and annual hatchery program operational costs.**

This program is funded through federal DJ/WB funds and the State General Fund. Hatchery Scientific Review Group (HSRG) is funding research through the Hatchery Reform Project to evaluate three fish cultural strategies implemented to recover Snow Creek coho salmon; Dr. Steve Schroeder, Research Scientist, and Thom H. Johnson, District Fish Biologist, of WDFW are the principal investigators.

**1.5) Location(s) of hatchery and associated facilities.**

Broodstock collection: at WDFW trap on Snow Creek (WRIA 17.0219) at RM 0.8. Hurd Creek Hatchery: located on Hurd Creek (WRIA 18.0028), a tributary to Dungeness River (WRIA 18.0018) at RM 3; eggs and milt transported to Hurd Creek Hatchery for fertilization, initial incubation and/or rearing, and otolith marking; eyed eggs transported to Snow Creek and Andrews Creek facilities; coho pre-smolts are blank-wire tagged and released into Crocker Lake after 7

months and 10 months rearing.
Snow/Andrews Creek remote sites: located at ~ RM 4 on Snow Creek, tributary to Discovery Bay, Strait of Juan de Fuca; and at ~ RM 1.5 on Andrews Creek (17.0221), tributary to Snow Creek; egg incubation, hatching, and volitional release of unfed fry in Remote Site Incubators (RSIs)

**1.6) Type of program.**

Integrated Recovery

**1.7) Purpose (Goal) of program.**

Restoration. The goal of this program is to contribute to the restoration of a healthy, natural, self-sustaining population of coho salmon that will maintain the genetic characteristic of the native stock.

**1.8) Justification for the program.**

Snow Creek coho salmon were identified as a critical stock in the 1992 WDFW/Tribal Salmon and Steelhead Stock Inventory (SASSI). Drastic reductions in coho adults and smolt abundance have occurred in Snow Creek since 1991. The intent of supplementation efforts is to reduce the short term extinction risk to the existing wild population and to increase the likelihood of their recovery to a healthy status. These objectives can be accomplished through the establishment of a supplemented populations using indigenous brood stock. The immediate objective for these populations will be to boost the population abundance as quickly as possible, increasing natural spawner densities to sustainable levels that will alleviate the risk of extinction to the populations. In keeping with the intended ephemeral nature of this form of artificial production, the proposed supplementation strategy will be limited in duration and designed to help maintain the populations while potential factors for decline are identified and being addressed. Monitoring and evaluation activities proposed for the programs will provide important new scientific information regarding the effectiveness of supplementation as it relates to coho salmon.

**1.9) List of program Performance Standards .**

The following are objectives for using supplementation in the recovery of the Snow Creek coho stock:

1) initiate a supplementation program using the natural origin Snow Creek coho broodstock, thus reducing short-term extinction risk and retaining future options for recovery of the Snow Creek population;

2) restore a healthy, natural, self-sustaining coho population that will maintain genetic characteristics of the natural origin stock;

3) boost the numbers of naturally produced fish in Snow Creek using the natural origin population as the donor; develop and maintain, for 9 years, a population comprised of supplemented and naturally spawning fish using hatchery and wild-origin broodstock;

4) monitor and evaluate, and annually report the effectiveness of the supplementation program.

**1.10) List of program Performance Indicators , designated by "benefits" and "risks."**

**1.10.1) Performance Indicators addressing benefits**.

***Estimate the contribution of supplementation program-origin coho to the natural population during the recovery process.***

1. Differentially mark all hatchery-origin coho fry to allow for distinction from natural-origin fish upon return as adults on the spawning grounds. This will be accomplished by otolith (thermal) marking or another permanent, effective method.
2. Operate a permanent trap and conduct spawning ground surveys throughout the coho return to enumerate spawners, and to collect information regarding fish origin (via random sampling of fish heads for otoliths), and age class composition through scale sampling.
3. Estimate the number of naturally spawning hatchery-origin coho contributing to the supplemented population s annual escapement.

***Collect and evaluate information on adult returns.***

1. Commencing with the first year of returns of progeny from naturally-spawned, hatchery-origin coho, evaluate results of spawning ground surveys and age class data collections to:
    a. Estimate the abundance and trends in abundance of spawners;
    b. Estimate the proportion of the escapement comprised by coho of hatchery lineage, and of wild lineage;
    c Through mark sampling, estimate brood year contribution for hatchery lineage and wild-origin fish.

Using the above information, determine whether the population has declined, remained stable, or has been recovered to sustainable levels. The ability to estimate hatchery and wild proportions will be determined by implementation plans, budgets, and assessment priorities.

**1.10.2) Performance Indicators addressing risks.**

***Monitor and evaluate any changes in the genetic, phenotypic, or ecological characteristics of the population presently affected by the supplementation program.***

1. Continue collecting and archiving DNA samples for future analysis.

***Determine the need, and methods, for improvement of supplementation operations or, if warranted, the need to discontinue the program.***

1. Determine the pre-spawning and green egg-to-fry, fry-to-fingering, and fingering-to-smolt survivals for each program at various life stages.
    a. Monitor growth and feed conversion.
    b. Maintain and compile records of cultural techniques used for each life stage, such as: collection and handling procedures, and trap holding durations, for coho broodstock; fish and egg condition at time of spawning; fertilization procedures, incubation methods/densities, temperature unit records by developmental stage, shocking methods, and fungus treatment methods for eggs; pending methods, start feeding methods, rearing/pond loading densities, feeding schedules and rates for juveniles; and release methods.
    c. Summarize results of tasks for presentation in annual reports.
    d. Identify where the supplementation program is falling short of objectives, and make recommendations for improved production as needed.

2. Determine if broodstock procurement methods are collecting the required number of adults that represent the demographics of the donor population with minimal injuries and stress to the fish.
    a. Monitor operation of adult trapping operations, ensuring compliance with established broodstock collection protocols for each station.
    b. Monitor timing, duration, composition, and magnitude of each run at each adult collection site.
    c. Collect biological information on collection-related mortalities. Determine causes of mortality, and use carcasses for stock profile sampling, if possible.
    d. Summarize results for presentation in annual reports. Provide recommendations on means to improve broodstock collection, and refine protocols if needed for application in subsequent seasons.

3. Monitor fish health, specifically as related to cultural practices that can be adapted to prevent fish health problems. Professional fish health specialists supplied by WDFW will monitor fish health.

a. Fish health monitoring will be conducted by a fish health specialist. Significant fish mortality to unknown causes will be sampled for histopathological study.
b. The incidence of viral pathogens in coho broodstock will be determined by sampling fish at spawning in accordance with procedures set forth in the Co-Managers of Washington Fish Health Policy (WDFW and WWTIT 1998).
c. Fish health monitoring results will be summarized in an annual report.

**1.11) Expected size of program.**

**1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).**

100% of the run, up to ~100 adults.

**1.11.2) Proposed annual fish release levels (maximum number) by life stage and location.**

| Life Stage | Release Location | Annual Release Level |
|---|---|---|
| Eyed Eggs | | |
| **Unfed Fry** | Snow Creek (17.0219)<br>Andrews Creek (17.0221) | 18,000<br>18,000 |
| **Fry** | | |
| Fingerling | Crocker Lake (Jefferson Cnty) | 9,000 |
| Yearling | Crocker Lake (Jefferson Cnty) | 9,000 |

**1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.**

None available. The first 3-year old coho adults will return from the supplementation program during fall, 2001 (no analysis provided at this time (12/16/02).

**1.13) Date program started (years in operation), or is expected to start.**

Started with brood year 1998.

**1.14) Expected duration of program.**

Ongoing; up to 9 years (3 brood cycles).

**1.15) Watersheds targeted by program.**

Snow Creek (WRIA 17.0219).

**1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.**

Alternative actions considered and implemented include integration with harvest recovery measures. Habitat recovery measures are being considered, but have not been implemented to date.

## SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS.

### 2.1) List all ESA permits or authorizations in hand for the hatchery program.

None. However,...

Two brood documents are reviewed and agreed to annually. The Future Brood Document (FBD) is a detailed listing of annual production goals. This is reviewed and updated each spring and finalized in July. The Current Brood Document (CBD) reflects actual production relative to the annual production goals and it is developed each spring after eggs are collected.

Two additional processes that involve co-managers include the "Annual Management Framework Plans" and "Salmon Run Status" reports for the Strait of Juan de Fuca, and the "Annual Winter and Summer Steelhead Forecasts and Management Recommendations", both are authored by the PNPTC, WDFW and Makah Tribe.

Although not directly related to hatchery programs, the North of Falcon Process should be mentioned as an avenue for developing harvest regulations. Conducted in concert with the Pacific Fisheries Management Council, this is an annual process that involves co-managers and stakeholders. The primary focus is to develop salmon fishing regulations for commercial and recreational fisheries in marine and freshwater areas.

In addition, WDFW hatchery programs in Puget Sound must adhere to a number of guidelines, policies and permit requirements. These constraints are designed to limit adverse effects on cultured fish, wild fish and the environment that might result from hatchery practices. Following is a list of guidelines, policies and permit requirements that govern WDFW hatchery operations:

*Genetic Manual and Guidelines for Pacific Salmon Hatcheries in Washington*. These guidelines define practices that promote maintenance of genetic variability in propagated salmon (Hershberger and Iwamoto 1981).

*Spawning Guidelines for Washington Department of Fisheries Hatcheries*. Assembled to complement the above genetics manual, these guidelines define spawning criteria to be used to maintain genetic variability within the hatchery populations (Seidel 1983).

*Stock Transfer Guidelines*. This document provides guidance in determining allowable stocks for release from each hatchery. It is designed to foster development of locally-adapted broodstock and to minimize changes in stock characteristics brought on by transfer of non-local salmonids (WDF 1991).

*Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State.* This policy designates and delineates Fish Health Management Zones and defines inter and intra-zone transfer policies and guidelines for eggs and fish. These are designed to limiting the spread of fish pathogens between and within watersheds. (WDFW, NWIFC, 1998).

*National Pollutant Discharge Elimination System Permit Requirements.* This permit sets forth allowable discharge criteria for hatchery effluent and defines acceptable practices for hatchery operations to ensure that the quality of receiving waters and ecosystems associated with those waters are not impaired.

**2.2) Provide descriptions, status, and projected take actions and levels for ESA-listed natural populations in the target area.**

**2.2.1) <u>Description of ESA-listed salmonid population(s) affected by the program.</u>**

**- Identify the ESA-listed population(s) that will be <u>directly</u> affected by the program.**

Summer chum salmon in Snow Creek may be directly affected by the coho supplementation program. The following is paraphrased from life history information for Hood Canal and Strait of Juan de Fuca summer chum presented in the Summer Chum Salmon Conservation Initiative (SCSCI)(WDFW et al. 2000):

Hood Canal and Strait of Juan de Fuca summer chum populations are one of three genetically distinct lineages of chum salmon in the Pacific Northwest region; and were designated as an evolutionarily significant unit (ESU) based upon distinctive life history and genetic traits. The uniqueness of the summer chum life history is best characterized by their late summer entry into freshwater spawning areas, and their late winter/early spring arrival in the estuaries as seaward-migrating juveniles. Reproductive isolation has been afforded by a significantly different migration and escapement timing and geographic separation from other chum stocks.

Summer chum spawning occurs from late August through late October. Eggs eye in redds after about 4 to 6 weeks incubation and hatch about 8 weeks after spawning. Fry emerge from redds, usually with darkness, between February and late May and immediately commence migration downstream to estuarine areas. Summer chum fry initially inhabit nearshore areas and occupy sublittoral seagrass beds for about one week and are thought to be concentrated in the top few meters of the water column both day and night. Upon reaching a size of 45-50 mm, fry move to deeper offshore areas. Migrating at a rate of 7-14 km per day, the southernmost outmigrating summer chum fry population in Hood Canal would exit the Canal 14 days after entering seawater (90% of population exits by April 28 each year, on average); and Strait of Juan de Fuca summer chum would exit the Discovery Bay area 13 days after entering seawater (90% completion by June 8 each year, on average).

Summer chum mature primarily at 3 and 4 years of age. The southerly ocean migration down the Pacific Northwest coast from rearing areas in the northeast

Pacific Ocean likely commences in mid-July and continues through at least early September. Adults enter terminal areas from early August through late September, with spawning ground entry timing in Hood Canal from late August through mid-October and in Strait of Juan de Fuca from early September through mid-October. Hood Canal and Strait of Juan de Fuca summer chum typically spawn soon after entering freshwater in the lowest reaches of natal streams. Low summer-time flows likely have acted to confine summer chum spawning in this region to the lowest reaches.

**- Identify the ESA-listed population(s) that may be <u>incidentally</u> affected by the program.**

The program may incidentally affect chinook salmon in the Puget Sound Chinook ESU. Suitable habitat for chinook is limited to rearing and foraging habitat in estuarine or nearshore areas adjacent to Snow Creek. It is not anticipated that the program will impact bull trout since none are known to be present in the area of the program.

**2.2.2) <u>Status of ESA-listed salmonid population(s) affected by the program.</u>**
**- Describe the status of the listed natural population(s) relative to critical and viable population thresholds.**

Critical and viable population thresholds under ESA have not been determined, however, the Snow Creek summer chum population was designated as critical through the 1992 WDFW-Tribal Salmon and Steelhead Stock Inventory process (WDF et al. 1993). In the SCSCI (WDFW et al. 2000), the Snow/Salmon Creek summer chum stock is identified as critical . In addition, a risk assessment using procedures for measuring extinction risk as presented by Allendorf et al. (1997) was done and the current risk of extinction was judged to be moderate after the initiation of a summer chum supplementation program on Salmon Creek; risk of extinction was judged to be high prior to initiation of the supplementation program.

**- Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.**

Data are not presently available for the natural population, but will be collected.

**- Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.**

Source is SCSCI (for 1987 through 1998) and WDFW files (for 1999 and 2000):
Snow Creek summer chum

| | |
|---|---|
| 1987 | 465 |
| 1988 | 723 |
| 1989 | 21 |
| 1990 | 33 |
| 1991 | 12 |
| 1992 | 21 |
| 1993 | 11 |
| 1994 | 2 |
| 1995 | 25 |
| 1996 | 160 |
| 1997 | 67 |
| 1998 | 27 |
| 1999 | 29 |
| 2000 | 30 |

**- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.**

Not known, but hatchery-origin summer chum released as fed fry from the Salmon Creek supplementation program have been recovered as adults in Snow Creek.

**2.2.3) Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimated annual levels of take**

**- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take**.

See section 2.2.1. Coho broodstock are collected at RM 0.8 in Snow Creek between October and January, which represents the entire period when natural spawning occurs. There may be an overlap with returning summer chum in October, but most have spawned or have spawned in the lower reaches of the creek.

The release of fish as described in this HGMP could potentially result in ecological interactions with listed species. These potential ecological interactions are discussed in Section 3.5, and risk control measures are discussed in Section 10.11. Implementation of the program modifications provided in this HGMP, and the actions previously taken by the comanagers, are anticipated to contribute to the continued improvement in the abundance of listed salmonids.

- **Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).**

None. See "take" table 1.

**- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.**

Not applicable.

## SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

**3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.**

This program is fully consistent with the guidelines, protocols, and implementation of the co-manager s Summer Chum Salmon Conservation Initiative (SCSCI) (WDFW et al. 2000). Fish production is consistent with the current Future Brood Document. The Current Brood Document reflects actual production relative to the annual production goals which are developed in the spring after eggs are taken from brood.

**3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.**

This HGMP is consistent with relevant standing orders and agreements. The Puget Sound Salmon Management Plan (PSSMP ) is a federal court order that currently controls both the harvest management rules and production schedules for salmon in Hood Canal under the *U.S. v. Washington* management framework.

**3.3) Relationship to harvest objectives.**

State and tribal co-managers are currently defining details of harvest objectives and management strategy as part of Puget Sound Comprehensive coho planning process.

**3.3.1) Describe fisheries benefitting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.**

No directed fisheries on coho salmon will result from adult fish produced through the Snow Creek coho supplementation program.

**3.4) Relationship to habitat protection and recovery strategies.**

None specifically identified for Snow Creek coho. However, the Snow Creek coho supplementation program will benefit from the habitat restoration and management measures as defined in the Summer Chum Salmon Conservation Initiative (WDFW et al. 2000). The SCSCI provides a standardized approach to determine freshwater and estuarine limiting factors in each summer chum watershed, including Snow Creek. Habitat factors for decline and recovery for each watershed are described. The goal of the habitat protections and restoration strategy is to maintain and recover the full array of watershed and estuarine-nearshore processes critical to the survival of summer chum across all life stages which will also benefit recovery of Snow Creek coho.

The comanagers resource management plans for artificial production in Puget Sound are expected to be one component of a recovery plan for Puget Sound chinook under

development through the Shared Strategy process. Several important analyses have been completed, including the identification of populations of Puget Sound chinook, but further development of the plan may result in an improved understanding of the habitat, harvest, and hatchery actions required for recovery of Puget Sound chinook.

**3.5) Ecological interactions.**

At time of outmigration and saltwater entry, coho salmon smolts produced through the Snow Creek program may prey directly on listed summer chum fry in freshwater and estuarine areas. However, the SCSCI considered the need for risk aversion measures that could be applied to the coho program to help minimize potential predation risks to summer chum. When the value of the program for recovery of the indigenous coho population was considered, it was decided to leave the coho supplementation and release program unaltered, but required that coho juveniles rearing in Snow Creek as a result of the supplementation program be monitored to identify survival rates and in-stream distribution in order to evaluate likely predation effects on summer chum.

The supplementation program will result in an increase in the number of coho salmon carcasses in freshwater areas and provide a source of nutrients which will benefit other salmonids and non-salmonids.

## SECTION 4. WATER SOURCE

**4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.**

Coho adults are trapped and held in Snow Creek for spawning, no water is removed from the creek for broodstock collection and holding purposes. Unfertilized gametes are transferred to WDFW s Hurd Creek Hatchery for fertilization, incubation and/or initial rearing. The hatchery, located 4 miles north of Sequim, Washington, is supplied with well water and water withdrawn form Hurd Creek, a tributary to the Dungeness River. The hatchery is permitted for the withdrawal of 6.4 cfs of water from these sources. Water from five (5) wells provide incubation and rearing supply for Snow Creek coho at Hurd Creek. Water quality is excellent, requiring only passage through a de-nitro tower to improve dissolved oxygen content. Hurd Creek surface water is available as an emergency back up supply. Surface water intake screens were upgraded to ESA compliance in 2000.

Eyed eggs will be returned to Remote Site Incubators (RSIs) that are gravity fed by springs tributary to Snow and Andrews creeks for final incubation and volitional release into the streams. Two sites on Snow Creek and one site on Andrews Creek use up to 10 gpm each during the period of operation (November - May). Water used for rearing at Snow and Andrews creeks is returned to the creeks near the point of withdrawal.

**4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.**

Hurd Creek Hatchery and Snow Creek and Andrews Creek facility withdrawal methods (wells, screened intakes) will not lead to injury or mortality to listed fish because the intake structures are located above natural barriers to fish migration (Snow and Andrews creeks) or are supplied by infiltration and are adequately screened to minimize risk to listed fish (Hurd Creek). At Hurd Creek, surface water emergency backup supply has ESA compliant screens. The Hurd Creek Hatchery and the Snow and Andrews creek remote facilities each produce a relatively small amount of fish each year, and well under the 20,000 pounds per year criteria set by WDOE as the limit for concern regarding hatchery effluent discharge effects and for the requirement for an NPDES permit. The remoteness of the Snow and Andrews creek locations provide additional security from potential vandalism of the water supply.

## SECTION 5. FACILITIES

### 5.1) Broodstock collection facilities (or methods).

Broodstock are collected for the program using a WDFW permanent weir and trap box positioned in Snow Creek at approximately RM 0.8. Captured fish are removed from the trap box and held in fish tubes constructed of perforated PVC pipe within a separate trap box until their daily removal for spawning or passage upstream. Fish are spawned directly adjacent to the trap. Spawning is accomplished as needed beneath an awning to protect the eggs and milt collected from the fish from rain. Eggs and milt are transported chilled in plastic bags and ice chests by truck to Hurd Creek Hatchery for fertilization and loading into iso-bucket incubators.

### 5.2) Fish transportation equipment (description of pen, tank truck, or container used).

Green eggs and milt are collected in separate containers for each adult and transported in plastic bags by truck from Snow Creek to Hurd Creek Hatchery. All are transported to Hurd Creek hatchery (30 minutes travel) in coolers containing ice to maintain temperature. Milt containers are oxygen loaded to enhance survival. Eyed eggs are transported moist to Snow and Andrews creek remote sites by truck in 5 gallon buckets cushioned by foam pads. Coho fingerlings are transported by tank truck aerated with regulated oxygen from an oxygen bottle via air stone and are released directly into Crocker Lake in the Snow Creek watershed.

### 5.3) Broodstock holding and spawning facilities.

Adults are held in 8" diameter or larger PVC pipe drilled with holes for water flow and closure devices on each end. These pipes containing fish are kept within the trap enclosure until ripe for spawning. Maturity of adults is checked on scheduled spawning days (usually twice a week). Fish are spawned directly adjacent to the trap. Spawning is accomplished as needed beneath an awning to protect the eggs and milt collected from the fish from rain.

### 5.4) Incubation facilities.

Incubation at Hurd Creek consists of down welling isolation buckets with effluent water being passed through an ultra-violet treatment unit with vertical half-stack incubators (Heath trays) used for hatching after viral certification. At the Snow and Andrews creek remote sites, eyed eggs are incubated in 55 gallon RSIs supplied with 2-10 gpm inflow through swim-up and volitional release. Each 55 gallon RSI will be loaded at low densities (8,000 eggs per RSI screen, up to 25,000 eggs per RSI).

### 5.5) Rearing facilities.

Coho are started and reared at Hurd Creek in 5' x 40' fiberglass raceway ponds. Coho are volitionally released as unfed fry from the RSIs on Snow and Andrews creeks.

**5.6) Acclimation/release facilities.**

Fry reared at Hurd Creek are released into Crocker Lake. Eyed eggs are also transferred to RSI units in the Snow Creek watershed for volitional release as unfed fry.

**5.7) Describe operational difficulties or disasters that led to significant fish mortality.**

None

**5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.**

Hurd Creek Hatchery is staffed full-time, with 24 hour stand-by, and equipped with many low-water alarms which help prevent catastrophic fish loss resulting from any type of water system failure. Pumping power would be provided with an emergency backup generator (at Hurd Creek only), equipped with an auto start, in the event of loss of normal power. The generator is capable of providing power to all hatchery components indefinitely, with fuel supplied as needed. Onsite fuel storage capacity is 1490 gallons, a seven day supply at full generator load. Further, a surface water backup supply from Hurd Creek can be supplied to the 5' x 40' raceways in the unlikely event of total loss of all power sources

Water required for rearing at the remote salmon rearing sites at Snow and Andrews creeks is supplied by gravity flow from natural springs. Incubating and rearing eggs and fry will therefore not be affected by power failures. The remote sites are not staffed full time, but are checked at least once daily during operation and more often during high flows and severe cold weather events. The remoteness of the locations provide additional security from potential vandalism of the water supply.

Due to the small stream size, no listed fish use the springs for spawning and rearing. Water removed from the springs for fish rearing is returned to the creek near the point of withdrawal. The Hurd Creek Hatchery and the Snow and Andrews creek remote facilities each produce a relatively small amount of fish each year, and well under the 20,000 pounds per year criteria set by WDOE as the limit for concern regarding hatchery effluent discharge effects and for the requirement for an NPDES permit. No adverse effects to listed fish populations are expected as a result of effluent discharge from the Hurd Creek and remote site operations.

## SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

**Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.**

### 6.1) Source.

Natural origin coho salmon broodstock were first collected from Snow Creek for the supplementation program in 1998.

### 6.2) Supporting information.

#### 6.2.1) History.

The founding Snow Creek coho stock was designated as critical in status by the Co-managers in SASSI. As a supplementation effort, the program is designed to increase the numbers of coho returning to Snow Creek, resulting in recovery of the population.

#### 6.2.2) Annual size.

The number of broodstock collected is consistent with the guidelines for supplementation programs developed in the SCSCI. As an emergency measure, and as specified for extremely small populations that are identified as at high risk of extinction, the supplementation program will be allowed to collect 100 % of the returning population for artificial propagation. This emergency measure will be continued until the population rebounds to annual return levels greater than 100 spawners (WDFW et al. 2000)

#### 6.2.3) Past and proposed level of natural fish in broodstock.

Only natural origin Snow Creek coho will be used as broodstock.

#### 6.2.4) Genetic or ecological differences.

The natural origin Snow Creek coho stock is the only source of broodstock. Hence, there are no known genotypic, phenotypic, or behavioral differences between the current supplementation stock and the natural stock, but it is being monitored.

#### 6.2.5) Reasons for choosing.

It is the natural origin coho salmon stock. No special traits or characteristics were selected for in the broodstock within the natural origin stock

**6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.**

The risk of among population genetic diversity loss will be reduced by selecting the natural origin coho salmon population for use as broodstock in the supplementation program. The retention of 100% of the coho trapped for use as broodstock reduces the likelihood of adverse genetic effects to the population that may result from non-random selection (either intentional or unintentional) of fish for artificial propagation.

## SECTION 7. BROODSTOCK COLLECTION

**7.1) Life-history stage to be collected (adults, eggs, or juveniles).**

Adults.

**7.2) Collection or sampling design.**

Coho broodstock are collected at RM 0.8 in Snow Creek between October and January, which represents the entire period when natural spawning occurs. A permanent weir and trap box are used to capture and hold adult fish for spawning. The lower river location of the trapping operation allows for access to virtually the entire coho return, helping to ensure that broodstock collected represent the total returning natural population. The retention of 100% of the coho trapped for use as broodstock reduces the likelihood of adverse genetic effects to the population that may result from non-random selection (either intentional or unintentional) of fish for artificial propagation. The weir and trap are checked at least daily by WDFW staff during operation, to ensure that the trap is operating properly and that any fish captured are held in safe condition. Monitoring of the trap is increased during freshets. Coho are held in a separate trap box and are further safeguarded from poaching or predation by being held in closed, ventilated PVC tubes.

**7.3) Identity.**

Only one coho population is present. Otolith marking of fry and blank-wire tagging of fingerlings and recovery of otoliths and tags from adults will allow identification of hatchery and natural-origin fish.

**7.4) Proposed number to be collected:**

**7.4.1) Program goal (assuming 1:1 sex ratio for adults):**

100% of coho adults returning to Snow Creek, up to 50 females, 50 males, and 25 jacks.

**7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:**

| Year | Adults Females | Males | Jacks | Eggs | Juveniles released |
|---|---|---|---|---|---|
| 1988 | | | | | |
| 1989 | | | | | |
| 1990 | | | | | |
| 1991 | | | | | |
| 1992 | | | | | |
| 1993 | | | | | |
| 1994 | | | | | |
| 1995 | | | | | |
| 1996 | | | | | |
| 1997 | | | | | |
| 1998 | 23 | 19 | 18 | 34,989 | |
| 1999 | 32 | 43 | 21 | 60,525 | |
| 2000 | 19 | 14 | 14 | 48,672 | |
| 2001 | 29 | 24 | 6 | 72,771 | |

**7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.**

The production of surplus eggs or fish is avoided to the extent feasible by limiting the number of adult coho secured through broodstock collection operations. Coho adults trapped in excess of program goals will be passed upstream to spawn naturally.

**7.6) Fish transportation and holding methods.**

None.

**7.7) Describe fish health maintenance and sanitation procedures applied**.

Fish health monitoring associated with adult fish used in the program is conducted through the WDFW Fish Health Division. The incidence of viral pathogens in coho broodstock will be determined by sampling fish at spawning in accordance with procedures set forth in the Co-Managers of Washington Fish Health Policy (WDFW and WWTIT 1998). Ovarian fluid, kidney, and spleen samples are collected from all fish spawned for evaluation by WDFW Fish Health Division staff for disease certification purposes.

**7.8) Disposition of carcasses.**

Returned to stream for nutrient enhancement.

**7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.**

The risk of fish disease amplification will be minimized by following Co-manager Fish Health Policy sanitation and fish health maintenance and monitoring guidelines. The natural origin population is the broodstock source. The multi-trait distribution of the broodstock closely matches the multi-trait distribution of the target population (similar spawn timing, size, appearance, age structure, etc.). The broodstock collection is technically and logistically possible.

## SECTION 8. MATING

**Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.**

**8.1) Selection method.**

As an emergency measure for extremely small populations at high risk of extinction, the supplementation program will be allowed to collect 100 % of the returning population for artificial propagation. This emergency measure will be continued until the population rebounds to annual return levels greater than 100 spawners. At that time, coho broodstock will be collected randomly as the fish arrive at the trap location, proportional to the timing, weekly abundance, and duration of the total return to the creek. The weir and fish trap are located in the lower reaches of the watershed, near the most downstream point of observed natural spawning activity so nearly the entire coho annual return to the creek is available to trapping, decreasing the risk that fish trapped through the program are not representative of the total run.

**8.2) Males.**

Use of backup males will be used when available. Jacks will be used proportional to their abundance in the total return to the creek.

**8.3) Fertilization.**

Coho adults collected at the Snow Creek weir are spawned adjacent to the weir site. Eggs and milt collected from spawned fish are placed separately in dry, zip-locked bags, and stored on ice for transport by truck to Hurd Creek Hatchery. Eggs will be fertilized at Hurd Creek Hatchery factorially, or using at least a 1:1 spawning ratio. Spawning protocols are done in accordance with the Co-Managers Fish Health Policy.

**8.4) Cryopreserved gametes.**

None used.

**8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.**

100% of adult returning to Snow Creek are used as broodstock (see 8.1). A factorial mating scheme or 1:1 individual matings will be applied to reduce the risk of loss of within population genetic diversity for the coho salmon population that is the subject of this supplementation program.

## SECTION 9. INCUBATION AND REARING -

**Specify any management *goals* (e.g. egg to smolt survival ) that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.**

### 9.1) Incubation:

#### 9.1.1) Number of eggs taken and survival rates to eye-up and/or pending.

Eggs are eyed and otolith marked at Hurd Creek. After eyeing ½ of the eggs (not exceeding approx 18,000) are maintained at Hurd Creek for rearing and later release to Crocker Lake. The remaining eggs are divided into two lots. One lot to RSIs on Snow Creek and the other to RSIs on Andrews Creek.

| Brood year | Green eggs | % survival to eye | Eyed eggs to RSIs | Unfed fry released from RSIs | Ponded at Hurd Crk | Fingerlings/ yearlings transferred to Crocker Lake |
|---|---|---|---|---|---|---|
| 1998 | 34,989 | 89.5 | 15,563 | 15,358 | 15,627 | 14,702 |
| 1999 | 60,575 | 92.5 | 37,360 | 35,897 | 18,440 | 17,754 |
| 2000 | 48,672 | 90.8 | 25,880 | in progress | 17,760 | to be shipped |

* - No data as yet for BY 2001 (12/16/02).

#### 9.1.2) Cause for, and disposition of surplus egg takes.

None anticipated.

#### 9.1.3) Loading densities applied during incubation.

Eggs are incubated in isolation buckets to the eyed stage, one to three females per bucket. After eyeing, eggs are hand picked, random mixed, divided into RSI and Hurd Creek rearing lots and transferred to vertical stack Heath trays for otolith marking. After otolith marks are applied the RSI lots are shipped to their respective sites. Water temperature to the Hurd Creek lots is manipulated to adjust development such that all takes are ponded on approx the same date. At the Snow and Andrews creek remote sites, eyed eggs are incubated in 55 gallon RSIs supplied with 2-10 gpm inflow through swim-up and volitional release. Each 55 gallon RSI will be loaded at low densities (8,000 eggs per RSI screen, up to 55,000 eggs per RSI).

**9.1.4) Incubation conditions.**

High quality water sources at Hurd Creek Hatchery and the remote sites also include setting basins and pose low or no siltation risk. Water temperature is constant 47 +/- 0.5 degrees F, except when otolith marking. Otolith marks are applied using chilled water at a temperature of 38 +/- 1.0 degrees F. Dissolved oxygen is a nominal 11.4 mg/l at the inlet.

**9.1.5) Pending.**

Pending at Hurd Creek occurs the last week of March/first week of April and a nominal 1300-1350 TUs, and varies depending on the take date. At the remote sites, unfed fry are volitionally released from the RSIs.

**9.1.6) Fish health maintenance and monitoring.**

All coho are incubated under the guidance of certified fish health personnel from WDFW and in accordance with the Co-Manager s Fish Health Policy (WDFW and WWTIT 1998). All eggs transferred from Snow Creek for fertilization at Hurd Creek Hatchery are water hardened in an iodophore solution. Fungus in incubators is controlled by formalin drip prior to the eyed stage. Eggs are shocked at eye-up to remove mortalities. Eggs are treated daily (to the eyed stage) with formalin injection (at a nominal 1667 ppm) to the incubation water at the isolation bucket supply header. Dead eggs are hand picked prior to transfer of eggs to vertical trays.

**9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.**

Eggs will be incubated using high quality water to minimize the risk of catastrophic loss due to siltation. All coho are incubated under the guidance of certified fish health personnel from WDFW and in accordance with the Co-Manager s Fish Health Policy (WDFW and WWTIT 1998); see 9.1.6 above.

## 9.2) Rearing:

**9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingering; fingering to smolt) for the most recent twelve years (1988-99), or for years dependable data are available.**.

Hurd Creek Hatchery

| Brood year | Survival eyed egg to fingering/yearling release | Survival fry to fingering/yearling release |
|---|---|---|
| 1998 | 98.4 % | 99.3 % |
| 1999 | 95.0 % | 99.7 % |
| | | |

Snow Creek and Andrews Creek remote sites

| Brood year | Survival eyed egg to unfed fry release |
|---|---|
| 1998 | 98.7 % |
| 1999 | 96.1 % |
| | |

**9.2.2) Density and loading criteria (goals and actual levels).**

At Hurd Creek Hatchery, per the WDFW Fish Health manual, the density index goal is < 0.3 and flow index < 2.0; actual density index does not exceed 0.15 and flow index does not exceed 1.1. At the Snow and Andrews creek remote sites, eyed eggs are incubated in 55 gallon RSIs supplied with 2-10 gpm inflow through swim-up and volitional release. Each 55 gallon RSI will be loaded at low densities (8,000 eggs per RSI screen, up to 55,000 eggs per RSI).

**9.2.3) Fish rearing conditions**

At Hurd Creek Hatchery, fry will be removed from incubators and ponded into fiberglass raceways upon absorption of the yolk sac. Temperature regimes and dissolved oxygen levels have posed no problems during routine operation of the facilities. Fish are reared in 5' x 40' fiberglass raceways. Cleaning is done at least weekly. Well water is the supply at 47 degrees F and a DO of 11.4 mg/l at a nominal 50 - 70 gpm. Loss is picked and recorded daily when loss occurs, Fish health is routinely monitored by WDFW Fish Pathologist monthly and before transfer. At Snow and Andrews creek remote sites, there is no rearing as unfed fry are volitionally released from RSIs.

**9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.**

NOMINAL FISH GROWTH

| Fish size (FPP) | wks from pond date |
|---|---|
| 1250 | 0 |
| 900 | 1 |
| 800 | 2 |
| 700 | 3 |
| 500 | 5 |
| 300 | 7 |
| 215 | 10 |
| 170 | 11 |
| 145 | 12 |
| 110 | 15 |
| 78 | 17 |
| 66 | 19 |
| 45 | 24 |
| 33 | 32 |
| 20 | 45 |

**9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.**

Not available.

**9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).**

Feed used is Bioproduct's "Biodiet Starter #2 and #3"; Moore "Clark's Fry". The fish are fed according to the manufacturer's recommendations and the hatchery specialists expertise. Food conversion efficiency ranges from 0.8 (starter) to 1.0 (pelletized).

**9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.**

The fish are monitored on a routine monthly basis by WDFW Fish Health Specialist in accordance with the Co-Manager s Fish Health Policy (WDFW and WWTIT 1998). Fish are monitored daily during rearing for signs of disease, through observations of feeding behavior and monitoring of daily mortality trends. Preferred and maximum pond loading and feeding parameters are adhered to at all times; see 9.2.2. Disease treatments have not been required to date.

**9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.**

NA

**9.2.9) Indicate the use of "natural" rearing methods as applied in the program.**

Fingerlings are transferred and released into Crocker Lake, a natural lake in the Snow Creek watershed, for natural rearing and acclimation. Program goal is 9000 fingerlings in the fall (November) and 9000 yearlings in the spring (March).

**9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.**

Hurd Creek Hatchery is staffed full-time to allow for rapid response to catastrophic events including flooding or power failure. A low flow alarm system and back-up generator also allow for appropriate response to water or power failures to safeguard rearing fish. At Snow and Andrews creek remote facilities , spring water is gravity fed to a water clarifying tank and remote site incubators. Water is supplied by small, screened ponds connected to PVC pipes and positioned up-gradient, at the source of the springs. More frequent checking of the water supply and facility will occur when periods of potential higher flows may pose additional risks. At both facilities, uniform rearing methods are applied across egg take groups. Fry are volitionally released at the remote sites which limits risk of domestication. Fish reared at Hurd Creek Hatchery are released into Crocker Lake in the Snow Creek watershed to acclimate and imprint fish to the native watershed.

## SECTION 10. RELEASE

**Describe fish release levels, and release practices applied through the hatchery program.**

### 10.1) Proposed fish release levels.

| Age Class | Maximum Number | Size (fpp) | Release Date | Location |
|---|---|---|---|---|
| Eggs | | | | |
| Unfed Fry | 18,000<br>18,000 | ~ 1275 fpp<br>~ 1275 fpp | Volitional; March-May | Snow Cr.<br>Andrews Cr. |
| Fry | | | | |
| Fingering | 9,000 | 50 | November | Crocker Lake |
| Yearling | 9,000 | 25 | February | Crocker Lake |

### 10.2) Specific location(s) of proposed release(s).

**Stream, river, or watercourse:** Snow Creek (17.0219)
**Release point:** Snow Creek (17.0219); Andrews Creek (17.0221); Crocker Lake (Jefferson County)
**Major watershed:** Snow Creek
**Basin or Region:** Puget Sound (Strait of Juan de Fuca)

### 10.3) Actual numbers and sizes of fish released by age class through the program.

| Release year | Eggs/ Unfed Fry | Avg size | Fry | Avg size fpp | Fingerling | Avg size fpp | Yearling | Avg size fpp |
|---|---|---|---|---|---|---|---|---|
| 1998 | | | | | | | | |
| 1999 | 15,358 | 1275 | | | 7,773 | 37 | | |
| 2000 | 35,897 | 1275 | | | 9,000 | 39 | 6,929 | 21 |
| 2001 | 25,301 | 1275 | | | 8,541 | 41 | 8,754 | 20 |
| Average | 25,519 | 1275 | | | 8,438 | 39 | 7,841 | 20 |

### 10.4) Actual dates of release and description of release protocols.

| | | | |
|---|---|---|---|
| 1999 | | 10/28/99 fingerlings | March-May unfed fry |
| 2000 | 2/15/00 yearlings | 10/24/00 fingerlings | March-May unfed fry |
| 2001 | 2/27/01 yearlings | 11/07/01 fingerlings | March-May unfed fry |

**10.5) Fish transportation procedures, if applicable.**

At Hurd Creek Hatchery, the fingerlings and yearlings are hauled to Crocker Lake in either a 300 gallon portable tank on a flat bed truck or 1000 gallon tank truck. The fill water is well water with a 0.5% salt concentration supply with oxygen at a rate of 1.5 lpm (portable tank) and 5 l pm (tanker). Loadings do not exceed 0.3 lbs/gallon for the portable tank and 0.45 lbs/gallon for the tanker. At the remote sites, unfed fry are volitionally released into Snow and Andrews creeks.

**10.6) Acclimation procedures**

Temperatures in Crocker Lake are monitored to insure no thermal shocking occurs.

**10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.**

All eggs are otolith marked, with differential marks for Snow Creek RSI, Andrews Creek RSI, and Crocker Lake groups. Blank coded-wired tags are inserted into the snouts of juveniles destined for fall release. Blank coded-wire tags are inserted into the adipose fins of juveniles destined for spring release.

**10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.**

None anticipated. There has been no surplus.

**10.9) Fish health certification procedures applied pre-release.**

The fish are checked by the area Fish Health Specialist before release.

**10.10) Emergency release procedures in response to flooding or water system failure.**

At Hurd Creek Hatchery, the fish are reared in raised raceways and therefore flooding is unlikely to cause an emergency. Hurd Creek's water supply wells are provided with a standby generator. Should both normal and standby power systems fail, oxygen from cylinders and a gasoline engine driven "trash" pump is available for recirculation. In any case because the fish are native Snow Creek, the fish will not be released into Hurd Creek. At the remote sites, unfed fry are volitionally released.

**10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.**

There are no listed fish in the area of release on Snow Creek, Andrews Creek, or Crocker Lake. At time of outmigration and saltwater entry, coho salmon smolts produced through the Snow Creek program may prey directly on listed summer chum fry in freshwater and estuarine areas. However, the SCSCI considered the need for risk aversion measures that could be applied to the coho program to help minimize potential predation risks to summer chum. When the value of the program for recovery of the indigenous coho population was considered, it was decided to leave the coho supplementation and release program unaltered, but required that coho juveniles rearing in Snow Creek as a result of the supplementation program be monitored to identify survival rates and in-stream distribution in order to evaluate likely predation effects on summer chum.

## SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

### 11.1) Monitoring and evaluation of Performance Indicators presented in Section 1.10.

#### 11.1.1) Describe plans and methods proposed to collect data necessary to respond to each Performance Indicator identified for the program.

It is planned that all Performance Indicators identified in Section 1.10 will be monitored and evaluated.

To date, the following Performance Indicators **addressing benefits** have been monitored for the Snow Creek coho supplementation program:

***Estimate the contribution of supplementation program-origin coho to the natural population during the recovery process.***

1. Differentially mark all hatchery-origin coho fry to allow for distinction from natural-origin fish upon return as adults on the spawning grounds. This will be accomplished by otolith (thermal) marking or another permanent, effective method.

To date, the following Performance Indicators **addressing risks** have monitored for the Snow Creek coho supplementation program:

***Monitor and evaluate any changes in the genetic, phenotypic, or ecological characteristics of the population presently affected by the supplementation program.***

1. Continue collecting and archiving DNA samples for future analysis.

***Determine the need, and methods, for improvement of supplementation operations or, if warranted, the need to discontinue the program.***

1. Determine the pre-spawning and green egg-to-fry, fry-to-fingering, and fingering-to-smolt survivals for each program at various life stages.
    a. Monitor growth and feed conversion.
    b. Maintain and compile records of cultural techniques used for each life stage, such as: collection and handling procedures, and trap holding durations, for coho broodstock; fish and egg condition at time of spawning; fertilization procedures, incubation methods/densities, temperature unit records by developmental stage, shocking methods, and fungus treatment methods for eggs; pending methods, start feeding methods, rearing/pond loading densities, feeding schedules and rates for juveniles; and release methods.
    c. Summarize results of tasks for presentation in annual reports.
    d. Identify where the supplementation program is falling short of objectives, and make recommendations for improved production as needed.

2. Determine if broodstock procurement methods are collecting the required number of adults that represent the demographics of the donor population with minimal injuries and stress to the fish.

a. Monitor operation of adult trapping operations, ensuring compliance with established broodstock collection protocols for each station.
b.Monitor timing, duration, composition, and magnitude of the run at the collection site.
c.Collect biological information on collection-related mortalities. Determine causes of mortality, and use carcasses for stock profile sampling, if possible.
d.Summarize results for presentation in annual reports. Provide recommendations on means to improve broodstock collection, and refine protocols if needed for application in subsequent seasons.

3. Monitor fish health, specifically as related to cultural practices that can be adapted to prevent fish health problems. Professional fish health specialists supplied by WDFW will monitor fish health.

a. Fish health monitoring will be conducted by a fish health specialist. Significant fish mortality to unknown causes will be sampled for histopathological study.
b. The incidence of viral pathogens in coho broodstock will be determined by sampling fish at spawning in accordance with procedures set forth in the Co-Managers of Washington Fish Health Policy (WDFW and WWTIT 1998).

More generally, the comanagers conduct numerous ongoing monitor programs, including catch, escapement, marking, tagging, and fish health testing. The focus of enhanced monitoring and evaluation programs will be on the risks posed by ecological interactions with listed species. WDFW is proceeding on four tracks:

1) An ongoing research program conducted by Duffy et al. (2002) is assessing the nearshore distribution, size structure, and trophic interactions of juvenile salmon, and potential predators and competitors, in northern and southern Puget Sound. Funding is provided through the federal Hatchery Scientific Review Group.

2) A three year study of the estuarine and early marine use of Sinclair Inlet by juvenile salmonids is nearing completion. The project has four objectives:

a) Assess the spatial and temporal use of littoral habitats by juvenile chinook throughout the time these fish are available in the inlet;
b) Assess the use of offshore (i.e., non-littoral) habitats by juvenile chinook;
c) Determine how long cohorts of juvenile chinook salmon are present in Sinclair inlet;
d) Examine the trophic ecology of juvenile chinook in Sinclair Inlet. This will consist of evaluating the diets of wild chinook salmon and some of their potential predators and competitors. Funding is provided by the USDD-Navy.

3) WDFW is developing the design for a research project to assess the risks of predation on listed species by coho salmon and steelhead released from artificial production programs. Questions which this project will address include:

a) How does trucking and the source of fish (within watershed or out of watershed) affect the migration rate of juvenile steelhead?
b) How many juvenile chinook salmon of natural origin do coho salmon and steelhead consume?
c) What is the rate of residualism of steelhead in Puget Sound rivers?
Funding needs have not yet been quanitifed, but would likely be met through a combination of federal and state sources.

4) WDFW is assisting the Hatchery Scientific Review Group in the development of a template for a regional monitoring plan. The template will provide an integrated assessment of hatchery and wild populations.

**11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.**

Funding, staffing, and support are available and committed for current Monitoring and Evaluation through brood year 2001. It is anticipated that WDFW will provide some funding, but that some outside funding will be needed in future years; it will be sought.

**11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.**

It is anticipated that adherence to monitoring and evaluation protocols in the SCSCI will not elevate risk to listed summer chum. Listed chinook salmon or bull trout are not present in the Snow Creek watershed and will not likely be affected by the program.

**11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.**

No adverse effects to listed fish are anticipated.

## SECTION 12. RESEARCH

The Hatchery Scientific Review Group (HSRG) is funding research through the Hatchery Reform Project to evaluate three fish cultural strategies implemented to recover Snow Creek coho salmon. The title of the research project is "Comparing the success of three fish cultural strategies implemented to recover Snow Creek coho salmon". HSRG research proposals and progress reports are available upon request.

### 12.1) Objective or purpose.

This project has three major goals. First, to simultaneously evaluate the effectiveness of an array of fish cultural strategies (Remote Site Incubators, Seven- and Ten-month hatchery rearing prior to release into the natal stream, and when abundance allows natural spawning) on coho salmon recovery in watersheds where this species is in extremely low abundance or no longer exists. Second, to discover if any of the incubation and rearing treatments used inadvertently domesticate the treated fish. And third, to use the project to recover coho salmon in Snow Creek, for without immediate intervention this unique coho population will be extirpated. The null hypotheses that are being tested in Part I are:
a) Fry-to-smolt survival rates in fish originating from each recovery strategy will not differ from one another.
b) The size and out-migration timing of smolts produced from each strategy will be the same.
c) The smolt-to-adult survival rates of fish originating from each recovery strategy will be equivalent
d) Adult coho produced from each treatment (RSIs, seven- and ten-month hatchery rearing prior to release back into their natal stream as pre-smolts) will possess comparable phenotypic traits. That is, the incidence of precocious maturation, size at maturity in each sex, fecundity, egg size, reproductive effort, and arrival timing back to Snow Creek will be comparable across all treatments.
e) Annual environmental variation will effect the survival and performance of coho originating from each recovery treatment in the same manner.

Project objectives are:
a) To determine the fry-to-smolt survival rates of coho originating from: a) RSIs, b) planted into Crocker Lake (an important over-wintering lake in the Snow Creek basin) after seven months or ten months of hatchery rearing, and c) when adult abundance allows, by natural production.
b) To trap all the coho smolts emigrating from Snow Creek and identify their treatment origin.
c) To document the arrival time and size (weight and length) of smolts originating from each treatment strategy just before they enter seawater.
d) To measure the smolt-to-adult survival of fish originating from each treatment group
e) To compare phenotypic attributes of adult coho produced from each treatment strategy
f) To analyze the recovery data collected on smolts and adults to determine the effects of annual environmental variation on the survival and performance of coho from each treatment.

**12.2) Cooperating and funding agencies.**

Cooperators: Washington Department of Fish and Wildlife (WDFW), Point No Point Treaty Council, Jamestown S'Klallam Tribe, Wild Olympic Salmon, North Olympic Salmon Coalition.

Funding: WDFW and HSRG. Volunteer hours from Wild Olympic Salmon and North Olympic Salmon Coalition.

**12.3) Principal investigator:**

Dr. Steven Schroder and Thom H. Johnson, WDFW.

**12.4) Status of stock (In addition to the information provided below, refer to section 2.2.1 2.2.2 and 2.2.3)**

Snow Creek coho identified as critical in SASSI. See sections 2.2.1-2.2.3.

**12.5) Techniques: include capture methods, drugs, samples collected, tags applied.**

All native coho salmon returning to Snow Creek will be collected at an existing weir. These fish will be mated in a factorial fashion and the eggs obtained from each female will be allocated into three different recovery treatments. DNA samples, scales, lengths, weight, fecundity, reproductive effort, mean egg size, and pathology samples will be collected from the adult fish. When their offspring reach the eyed-stage of development, the eggs assigned to each treatment group will be thermally marked so that their origin can be ascertained at later stages in the life cycle. Approximately nine thousand fish will be reared for seven-months, another nine thousand will experience a ten-month rearing period prior to being released into Crocker Lake. The remaining eggs will be placed into Remote Site Incubators located in the Snow Creek basin. The performance and survival of fish from each treatment will be evaluated at the smolt and adult stages. When adult coho abundance increases, some of these fish will be liberated into Snow Creek to reproduce under natural conditions. The survival and performance of their offspring will be compared to the other treatments.

**12.6) Dates or time period in which research activity occurs**

The creation of the various treatment groups was initiated with brood year 1998 and will continue until 2006 (a total of nine years or three generations) and adult trapping will finish in 2009.

**12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.**

See Sections 5 through 10.

**12.8) Expected type and effects of take and potential for injury or mortality**

None anticipated.

**12.9) Level and take of listed fish**

None anticipated.

**12.10) Alternative methods to achieve project objectives.**

None.

**12.11) List species similar or related to the threatened species: provide number and causes of mortality related to this research project**

None.

**12.12) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.**

See Sections 3.5 and 10.11.

## SECTION 13. ATTACHMENTS AND CITATIONS

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Washington Department of Fish and Wildlife and Point-No-Point Treaty Tribes. 2000. Summer Chum Salmon Conservation Initiative. Hood Canal and Strait of Juan de Fuca Region. Jim Ames, Chris Weller, Gary Graves, editors. Fish Program, Washington Department of Fish and Wildlife, Olympia.

## SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

I hereby certify that the foregoing information is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973.

Name, Title, and Signature of Applicant:

Certified by_____ Date:_____

Table 1. Estimated listed salmonid take levels by hatchery activity: **NONE**

| **Listed species affected: Chinook ESU/Population: Puget Sound Activity: Snow Creek coho salmon supplementation** | | | | |
|---|---|---|---|---|
| **Location of hatchery activity: Snow Creek remote sites/Hurd Creek Hatchery Dates of activity: ongoing Hatchery program operator: WDFW** | | | | |
| **Type of Take** | **Annual Take of Listed Fish By Life Stage *(Number of Fish)*** | | | |
| | Egg/Fry | Juvenile/Smolt | Adult | Carcass |
| **Observe or harass a)** | | | | |
| **Collect for transport b)** | | | | |
| **Capture, handle, and release c)** | | | | |
| **Capture, handle, tag/mark/tissue sample, and release d)** | | | | |
| **Removal (e.g. broodstock) e)** | | | | |
| **Intentional lethal take f)** | | | | |
| **Unintentional lethal take g)** | none | none | | |
| **Other Take (specify) h)** | | | | |

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

Table 1. Estimated listed salmonid take levels by hatchery activity.

| **Listed species affected: Summer Chum ESU/Population: Hood Canal Activity: Snow Creek coho salmon supplementation** | | | | |
|---|---|---|---|---|
| **Location of hatchery activity: Snow Creek remote sites/Hurd Creek Hatchery Dates of activity: ongoing Hatchery program operator: WDFW** | | | | |
| **Type of Take** | **Annual Take of Listed Fish By Life Stage *(Number of Fish)*** | | | |
| | Egg/Fry | Juvenile/Smolt | Adult | Carcass |
| **Observe or harass a)** | | | | |
| **Collect for transport b)** | | | | |
| **Capture, handle, and release c)** | | | | |
| **Capture, handle, tag/mark/tissue sample, and release d)** | | | | |
| **Removal (e.g. broodstock) e)** | | | | |
| **Intentional lethal take f)** | | | | |
| **Unintentional lethal take g)** | Unknown | Unknown | | |
| **Other Take (specify) h)** | | | | |

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.

b. Take associated with weir or trapping operations where listed fish are captured and transported for release.

c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.

d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.

e. Listed fish removed from the wild and collected for use as broodstock.

f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.

g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.

h. Other takes not identified above as a category.